Claims

1. An illuminator comprising light sources mounted on a substrate and an integrally moulded lens covering the light sources, characterised in that,

the substrate comprises a layer of semiconductor material and pads of conductive and reflective material overlying the semiconductor material,

said pads are electrically connected to the light sources to provide power, and

the substrate is mounted directly on a heat sink.

2. An illuminator as claimed in claim 1, wherein the moulded lens material extends completely over the substrate and a top portion of the heat sink to hermetically seal the substrate and the light sources.

3. An illuminator as claimed in claim 1, wherein the substrate comprises a layer of electrically-insulating material over the semiconductor material and the pads overlie said electrically-insulating layer.

4. An illuminator as claimed in claim 3, wherein said electrically-insulating material comprises an oxide of the semiconductor material.

5. An illuminator as claimed in claim 4, wherein the oxide is thermally grown and has a dielectric strength in excess of 5×10^6 V/cm.

6. An illuminator as claimed in claim 5, wherein the oxide comprises SiO_2.

7. An illuminator as claimed in claim 5, wherein the oxide depth is at least 2 microns.

8. An illuminator as claimed in any preceding claim, wherein the pads comprises reflective silver or gold.

9. An illuminator as claimed in any preceding claim, wherein the pads comprise a top sub-layer of a reflective metal over at least one adhesion sub-layer.

10. An illuminator as claimed in claim 9, wherein said adhesion sub-layer comprises Ti.

11. An illuminator as claimed in claim 9, wherein said adhesion sub-layer comprises Ni.

12. An illuminator as claimed in any of claim 9, wherein said sub-layers are deposited by evaporation over the oxide of the semiconductor material.

13. An illuminator as claimed in any of claim 8, wherein said sub-layers each have a depth in the range of 50 nm to 3 microns.

14. An illuminator as claimed in claim 1, wherein said light sources comprise semiconductor die placed and wire bonded on said tracks.

15. A method of producing an illuminator of the type comprising light sources mounted on a substrate and an integrally moulded lens covering the light sources, the method comprising the steps of:

providing a semiconductor material base,

depositing pads of electrically conductive and optically reflective material on the base to provide a substrate,

placing the light sources and electrical connectors on the pads of the substrate,

adhering the substrate at a lower surface of the base to a heat sink, and

moulding a lens over and around the substrate to hermetically seal the substrate and the light sources.

16. A method as claimed in claim 15, comprising the further step of growing an oxide layer on a surface of the base, and depositing the pads on the oxide layer.

17. A method as claimed in claim 16, wherein the oxide layer is grown to a depth of at least 2 microns.

18. A method as claimed in claim 15 wherein the base is of silicon material and the oxide is silicon dioxide.

19. A method as claimed in any of claim 15, wherein the pads are deposited by patterning with use of a photo-resist.

20. A method as claimed in any of claim 15, wherein the lens is moulded by placing the substrate upside-down in a mould cavity and filling the cavity until liquid lens material surrounds the substrate.

21. A method as claimed in claim 20, wherein the mould is sloped during filling, and the cavity is filled from the higher end.